

WHAT IS CLAIMED IS:

- 1) A heat engine comprising:
  - a working fluid;
  - a plurality of movable pistons;
  - at least one compression cylinder having a plurality of said movable pistons receivable within said at least one compression cylinder defining variable volume fluid chambers between said pistons and having said working fluid occupying a space within said chambers;
  - at least one expansion cylinder having a plurality of said movable pistons receivable within said at least one expansion cylinder defining variable volume fluid chambers between said pistons and having said working fluid occupying a space within said chambers;
  - an entry point on one side of said at least one compression cylinder whereby when said engine is in operation, said pistons and said working fluid are at a relatively low pressure state upon entering therein;
  - an exit point on one side of said at least one compression cylinder opposite the side of said entry point whereby when engine is in operation, said pistons and said

working fluid are at a relatively high pressure state upon exiting thereof;

a force acting on said pistons received within said at least one compression cylinder in addition to the forces exerted by said working fluid on said pistons, that propels said pistons through said at least one compression cylinder from said entry point toward said exit point;

an entry point on one side of said at least one expansion cylinder whereby when said engine is in operation, said pistons and said working fluid are at a relatively high pressure state upon entering therein;

an exit point at one side of said at least one expansion cylinder opposite the side of said entry point whereby when engine is in operation, said pistons and said working fluid are at a relatively low pressure state upon exiting thereof;

a force acting on said pistons received within said at least one expansion cylinder in addition to the forces exerted by said working fluid on said pistons that resists the movement of said pistons through said at least one expansion cylinder from said entry point toward said exit point;

a means to add heat to said working fluid;

a means to remove heat from said working fluid; and,

a power transfer means to transfer power between said engine and an apparatus.

2) An engine according to claim 1, wherein said entry point of said at least one compression cylinder is at a higher elevation than said exit point of said at least one expansion cylinder, and wherein gravity pulls the pistons within said at least one expansion cylinder downward from said entry point toward said exit point.

3) An engine according to claim 1, wherein said entry point of said at least one expansion cylinder is at a lower elevation than said exit point of said at least one compression cylinder, and wherein gravity resists the movement of said pistons upward from said entry point toward said exit point.

4) An engine according to claim 1, wherein an electromagnetic force is utilized to force said pistons in a desired direction.

5) An engine according to claim 4, wherein at least some of said pistons contain magnets, and wherein a plurality of

electromagnets are positioned along at least a partial path of said piston which are turned on and off in a sequence that creates attractive and/or repulsive forces that assist in propelling said pistons in the desired direction.

- 6) An engine according to claim 1, wherein the movement of said piston creates a relative motion between a magnet and a conductive wire resulting in an induced electrical current in said wire.
- 7) An engine according to claim 6, wherein at least some of said pistons contain magnets, and wherein conductive wires are positioned along at least a portion of said path of said pistons and said wires have an output for supplying current to a load.
- 8) An engine according to claim 1, wherein when operating as a forward heat engine producing a net work output, heat is added to said working fluid while said fluid is at a high average temperature and pressure, and heat is removed from said working fluid while said fluid is at a low average temperature and pressure.

9) An engine according to claim 8, wherein said exit point of said at least one expansion cylinder is at a higher elevation than said entry point of said at least one compression cylinder and an apparatus is utilized to convert the gravitational potential energy of said pistons to a rotational work output as said pistons are lowered from said exit point of said at least one expansion cylinder to said entry point of said at least one compression cylinder.

10) An engine according to claim 8, wherein when operating according to an open cycle with air as said working fluid, heat is added to the air by combusting a fuel directly in the air.

11) An engine according to claim 1, utilizing an external work input to operate as a reverse heat engine whereby heat is added to said working fluid while said fluid is at a low average temperature and pressure, and heat is rejected from said working fluid while said fluid is at a high average temperature and pressure.

12) An engine according to claim 11, wherein said exit point of said at least one expansion cylinder is at a lower

elevation than said entry point of said at least one compression cylinder and a mechanical lifting apparatus is utilized to raise said engine pistons from said exit point of said at least one expansion cylinder to said entry point of said at least one compression cylinder.

13) An engine according to claim 1, wherein heat is conducted through the walls of said at least one expansion cylinder transferring heat between said working fluid and an external body.

14) An engine according to claim 1, wherein one or both ends of said at least one compression cylinder and at least one expansion cylinder are connected in a continuous fashion.

15) An engine according to claim 1, wherein said at least one compression cylinder and said at least one expansion cylinder are connected via one or more passageways to transfer said pistons and said working fluid between said pistons.

16) An engine according to claim 15, wherein said pistons within said passageway are forced closer together displacing said working fluid between said pistons.

17) An engine according to claim 15, wherein said pistons within said passageway are forced further apart such that working fluid is drawn in to occupy the volume between said pistons.

18) An engine according to claim 1, wherein said pistons are connected by a mechanical linkage which prevents said pistons from moving more than a maximum desired distance apart.

19) An engine according to claim 1, wherein a mechanical spacer prevents the volume between said pistons from decreasing to more than a minimum desired volume.

20) An engine according to claim 1, wherein the shape of the cross section of said cylinders are a noncircular shape.

21) An engine according to claim 20, wherein the shape of the cross section of said pistons are a noncircular shape.

22) An engine according to claim 1, further comprising a means to adjust the degree of inclination of one or more of said engine cylinders.

23) An engine according to claim 1, further comprising a means to adjust the pressure of said working fluid entering said at least one compression cylinder.

24) An engine according to claim 1, further comprising a plurality of holes in the wall of said cylinders and a valve means in fluid-flow communication with said hole to allow the movement of working fluid in or out of said cylinders.

25) An engine according to claim 1, wherein said engine pistons have a roller means to support the lateral force exerted by said pistons on the wall of the respective cylinders.

26) An engine according to claim 1, wherein said engine pistons are broken into segments that move relative to each other to conform the shape of the respective cylinders.

- 27) A method for a heat engine, comprising the steps of:
- a. obtaining a heat engine comprising a working fluid; a plurality of movable pistons; at least one compression cylinder having a plurality of said movable pistons receivable within said at least one compression cylinder defining variable volume fluid chambers between said pistons and having said working fluid occupying a space within said chambers; at least one expansion cylinder having a plurality of said movable pistons receivable within said at least one expansion cylinder defining variable volume fluid chambers between said pistons and having said working fluid occupying a space within said chambers; an entry point on one side of said at least one compression cylinder whereby when said engine is in operation, said pistons and said working fluid are at a relatively low pressure state upon entering therein; an exit point on one side of said at least one compression cylinder opposite the side of said entry point whereby when engine is in operation,

said pistons and said working fluid are at a relatively high pressure state upon exiting thereof; a force acting on said pistons received within said at least one compression cylinder in addition to the forces exerted by said working fluid on said pistons, that propels said pistons through said at least one compression cylinder from said entry point toward said exit point; an entry point on one side of said at least one expansion cylinder whereby when said engine is in operation, said pistons and said working fluid are at a relatively high pressure state upon entering therein; an exit point at one side of said at least one expansion cylinder opposite the side of said entry point whereby when engine is in operation, said pistons and said working fluid are at a relatively low pressure state upon exiting thereof; a force acting on said pistons received within said at least one expansion cylinder in addition to the forces exerted by said working fluid on said pistons that resists the movement of said

pistons through said at least one expansion cylinder from said entry point toward said exit point; a means to add heat to said working fluid; a means to remove heat from said working fluid; and, a power transfer means to transfer power between said engine and an apparatus; and

- b. advancing said pistons in a nonhorizontal motion through said at least one compression cylinder and through said at least one expansion cylinder.